

Radioactive waste management in Central Asia

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Abstract. After the collapse of the Soviet Union the newly independent states in Central Asia whose regulatory bodies were set up recently are facing problems with the proper management of radioactive waste and so called “nuclear legacy” inherited from the past activities. The regulatory framework of these countries requires improvement and harmonization with the international standards.

1. INTRODUCTION

During the former Soviet Union (SU) period, various aspects of nuclear energy use took place in Central Asian (CA) republics of Kazakhstan, Kyrgyzstan, and Tajikistan. Activities ranged from peaceful use of energy to nuclear testing for example at the former Semipalatinsk Nuclear Test Site in Kazakhstan, and uranium mining and milling industries in all four countries. Large amounts of radioactive waste (RW) have been accumulated in CA and are waiting for its safe disposal. For instance, the radioactive waste in Kazakhstan makes up 237.2 million tons with the total activity of $5.7 \cdot 10^{17}$ Bq, including 450 tons of high-level RW with the activity of $7.03 \cdot 10^{16}$ Bq; 6.5 million tons of intermediate-level RW with the activity of $4.88 \cdot 10^{17}$ Bq; and 230.7 million tons of low-level RW with the activity of $1.09 \cdot 10^{13}$ Bq [1]. After the collapse of SU these newly independent states whose regulatory bodies were set up recently faced problems with the proper management of RW and so called “nuclear legacy” inherited from the past activities. In all these countries RW has not been placed in licensed sites for the long-term storage and final disposal. To solve the problem related to the lack of licensed RW storage and disposal sites, a minimum requirement is to develop criteria for RW disposal. Many radioactive waste storage facilities in CA, especially in Kyrgyzstan and Tajikistan, are located in regions of seismic activity, in landslide and mudflow-prone areas and areas subject to flooding and high ground water levels, and near the banks of the rivers that form the base of the large water basin of the Central Asian region. Many tailings are situated near towns, other populated areas and state borders, and they represent a long-term hazard to health and the environment.

2. OBJECTIVES

The overall objective is to identify and draft relevant regulatory requirements to ensure the protection of the personnel, population and environment during planning and conducting of works for RW management in CA. The scope of the projects falls within the context of the Norwegian Plan of Action is to ensure that activities related to RW management in both planned and existing exposure situations in CA will be carried out in accordance with the international guidance and recommendations, taking into account the regulatory practice from other countries in this area.

3. METHODS

In 2008 the Norwegian Radiation Protection Authority (NRPA), with the support of the Norwegian Ministry of Foreign Affairs, has developed bilateral projects that aim to assist the regulatory bodies in Kazakhstan, Kyrgyzstan and Tajikistan to identify and draft relevant regulatory requirements to ensure the protection of the personnel, population and environment during the planning and execution of remedial actions for past practices and radioactive waste management in the CA countries [2]. The participating regulatory authorities included: Kazakhstan Atomic Energy Agency, Kyrgyzstan State Agency on Environmental Protection and Forestry and Nuclear Safety Agency of Tajikistan.

4. ANALYSES

In order to understand the problems in the field of RW management we have analysed the existing regulations through the so called "Threat assessment" approach in each CA country [3].

4.1 Kazakhstan

The regulatory basis existing in Kazakhstan covers following objects and kinds of activity in the field of atomic energy use: power reactors, research reactors, the enterprises for processing wastes, storage places for spent fuel and a high-level wastes, storage places for low-level wastes, high-level wastes disposal, low-level wastes disposal, fuel production plants, uranium mining and processing, radioactive sources, by-product radioactive materials, radiography, packing and transportation of radioactive materials. In Kazakhstan there are regulated the following issues: radiation protection, maintenance of quality, environment protection, emergency situations planning, fire safety, carrying out of technological operations, maintenance service, training and certification of the personnel, nuclear safety, of physical protection measures, safety analysis development, impact to personnel, siting, designing and building, the organization and performance of researches (including experimental works), decommissioning of installations, the account and the control of nuclear materials, etc. A number of regulatory documents completely correspond to the international requirements and recommendations. Established by Radiation Safety Norms (HPB-99) exposure dose limits for the personnel and the populations caused by any sources of an ionizing radiation (including the radioactive wastes) are in accordance with the IAEA recommendations [4]. The established procedure of licensing activity in the area of an atomic energy use as one of the basic qualifying requirements demands to develop "Quality assurance program" for the licensing activity and to get its approval by the authorities. Regulatory infrastructure created in the Republic of Kazakhstan insignificantly differs from the systems regulating radioactive waste management in the developed countries. However some 120 of the "norms" and "rules of the existing 238 regulatory documents in Kazakhstan were either approved and put in force in SU times by the authorities of the USSR which do not correspond to a present day reality in the atomic power industry of Kazakhstan, and need to be revised within the next years in order to provide an effective regulation of the activities connected with use of atomic energy in Kazakhstan. For example, issues related to RW processing and final disposal are not developed well enough in a current regulatory basis. In particular only one way of underground disposal has been reflected in the "Rules on Radioactive Waste Management" (IIOPPO 97). At the same time there is no determined time

scale of disposal facility operation as well as disposal site decommissioning issues. The requirements for RW disposal are not developed in details because the suggested way of RW placement in the underground facility definitely will not be able to satisfy the requirements for the time period longer than 50 years. There is no clear division of the requirements and the criteria for choosing sites and its usage, additionally; disposal ways for low, medium and high-level wastes are not established. Existing regulations on radioactive waste disposal procedure need addition in a form of document which defines the siting criteria for RW underground disposal (geological, seismological, hydro geological) as well as this document should define the procedure of transfer from operation period to the decommissioning. In terms of RW processing the criteria on cementation and bitumization are established only, while criteria for high-level wastes processing are absent. There should be defined both technical criteria and safety requirements that are the basis for the limits, conditions and control of any facility or activity with radioactive wastes.

4.2 Kyrgyzstan

The analysis of the regulations in Kyrgyzstan revealed the following problems: the national legal and regulatory framework on radiation safety does not harmonize with the international recommendations; most acts of the legislation are general, superfluously abstract and declaratory (for instance, the mechanisms of realization of the citizens' rights to radiation safety are actually absent therein), and they lack the direct-action propositions that requires the development of the procedures and mechanisms of their execution in detail in the by-laws; the legislation base and methods for an estimate of harm (safety assessment) to the health of citizens and the environment caused by radioactive contamination, are absent; wide powers of the local authorities on their territories are not specified in the basic Law of Kyrgyzstan "On the Local State Administration and the Local Government", i.e. the legislation is unsettled; legal tools for the movement of RW within the republic's borders, and for the cases of transboundary movement settled in the established order, are absent; mechanisms of implementation of requirements at privatization of facilities for operation, RW placing, and requirements to owners' ecological liability, are absent; economic tools to promote owners' interest in radiation safety are absent. The government should establish an effective system for protective actions to reduce undue radiation risks associated with unregulated sources (of natural and artificial origin) and contamination from past activities or events, consistent with the principles of justification and optimization. Decommissioning of facilities and the safe management and disposal of radioactive waste should constitute essential elements of the governmental policy and the corresponding strategy over the lifetime of the facilities and radioactive sources and for the duration of activities. The extent of the regulatory control applied should be commensurate with radiation risks associated with facilities and activities, in accordance with a graded approach. The safety assessment may need to be repeated or reaffirmed by the regulatory body in support of its decision.

4.3 Tajikistan

The system of management for radioactive waste and uranium production waste in Tajikistan was mainly regulated by the "Sanitary Rules" developed as long

ago as from 1984 to 1991 (i.e. when Tajikistan was a republic within the USSR), as well as by a number of normative-legal documents concerning management of industrial and toxic waste. During the recent years, a number of regulations and regulatory standards are being developed. However, the normative-regulatory base of Tajikistan in the field of management of waste of the former uranium production has not been fully completed yet and requires an improvement and harmonization with the basic safety standards of the IAEA. In particular, the country still lacks the norms and recommendations on how to provide safe management and rehabilitation. In some cases the enterprises can not make a decision on the expediency of secondary processing of the uranium production waste, and to provide it for a lack of practice and adequate mechanisms on how to perform such work within the current legislation. In particular, for the most oldest uranium facilities in the country, such important characteristics of regulation and implementation of radiation protection principles as the “control levels” and “reference levels” have not been defined; there are no clear-cut requirements for the safety assessment, system of monitoring and reports; the dose constraints for personnel and the public have not been determined; there has not been set any criteria for the clearance and release of materials and uranium facilities from regulatory control, which can be used as the safety criteria in waste management; there has not been established any safety requirements for post-closure institutional control, nor any other important norms suggested in the basic standards of the IAEA on ensuring radiation safety as an effective tool in control existing exposure situations (past practices). At those facilities where such zones are formally established (Taboshar) or even where the fences are available (Degmay), there is often no possibility to organize relevant supervision of the state of the facilities and to prohibit the access of people and grazing cattle to the territories of the tailings impoundments.

5. RESULTS

The legacy problems left behind by uranium mining and milling in CA countries are not very different one from another. Based on the analysis of the existing situations in the field of radioactive waste management in CA the most important constraints to the development and implementation of efficient regulatory control, monitoring systems, and the planning and implementation of remediation plans, can be summarized as follows: inadequate regulatory and legislative framework for the safe management of radioactive waste; limited availability of national funding; inadequate legislative and regulatory framework for the operation, closure and environmental remediation of mines; inadequate knowledge of the inventory of the legacy components and the risks associated with them; cross-border regional problems related to the former uranium facilities in CA countries. In order to remove the threat connected with

radioactive wastes, both that which has already been accumulated as a result of previous activities and that which is currently being generated in significant amounts and will be produced in the future, it is necessary to at least develop and implement: 1) A National Policy and Strategy for RW management, including strategies for disposal of each category of the RW, allocation of responsibilities and financial assurance for these activities; 2) Safety requirements on the design, siting, construction, operation, closure and establishment of the institutional control needed for disposal facilities in accordance with the approved national policy and strategy on radioactive waste management and 3) New classifications of radioactive waste according to the recently published international recommendations, including identification of corresponding categories. In order to remove the threats connected with extensive territories contaminated by radionuclides, the rehabilitation of these areas is required and, accordingly, it is necessary to develop regulations on: 1) Quantitative criteria defining reference levels for existing exposure situations, considering its justification, optimization and the graded approach; 2) Criteria and hygienic specifications on the rehabilitation of territories contaminated with radioactive materials; 3) The radiation safety of the personnel and the population during the subsequent use of the territory, a buildings and constructions after rehabilitation; 4) Reference levels for exposure dose constraints to prevent unreasonable irradiation of the population on the territories with radioactive contamination, and also to develop derived reference levels for the values of radiation parameters which can be directly measured when implementing radiation control; and 5) Updating the exemption and clearance levels with the latest international recommendations. In case of secondary processing of the uranium tailings impoundments and extraction of uranium or other minerals from mine waters, it is necessary to implement and enforce an authorization process that will require the potential investors to be responsible for the implementation of the projects concerning restoration at every tailings impoundment involved. This process should include: performance of a safety assessment and radiological impact assessment; rehabilitation and secondary processing of the uranium tailings impoundments; final disposal and rehabilitation of the off-balance ores and extraction of uranium from mine waters; final disposal and rehabilitation or secondary processing of the uranium tailings impoundments; organization of permanent radiation monitoring at existing tailings impoundments.

6. CONCLUSION

Taking into consideration that the level of the threats associated with the presence of extensive territories that have already been contaminated with radionuclides could be considerably reduced and remain at acceptable level within a reasonable period of time if the following actions would be taken: establishing a strong and effective legal and regulatory framework, including the proper enforcement actions to guarantee the safe management of remedial actions and radioactive waste management, and at the same time providing the assurance that similar situations will not repeated; carrying out the safety assessment and radiological impact assessment for the contaminated territories and, in accordance with the results of these assessments, to take the needed measures to diminish the risks; carrying out institutional control, including the long-term monitoring and control over the abandoned objects of the uranium

industry where it is necessary to prevent unjustified exposure of the public; carrying out institutional control, including the long-term monitoring and control over nuclear test sites (in Kazakhstan) where it is necessary to prevent unjustified exposure of the public; carrying out monitoring and regulatory control over the places of gas and oil production that have contaminated soils and storage places for the contaminated pipes and the equipment, and also taking the proper security measures where it is necessary to prevent unauthorized access to the contaminated areas. Only with a strong regulatory infrastructure in place would it be possible to avoid the repetition of such bad experiences in ongoing practices and facilities or in new coming projects. The conclusion made above is extensive to all of the CA countries.

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